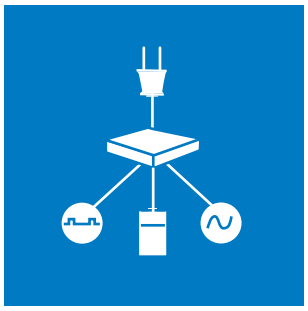
查询IMP2014-4.0JUK/T供应商



POWER MANAGEMENT

LDOs

IMP37 — Low Dropout Positive Voltage Regulator
With 800mA Output

IMP2014/15, IMP2185 — Super Low Dropout CMOS Regulators
With Battery Life Extending Shutdown Mode

IMP2054/55, IMP2186 — Super Low Dropout CMOS Regulators
With Battery Life Extending Shutdown Mode and ERROR Output

IMP2070/71, IMP2187 — Super Low Dropout CMOS Regulators
With Battery Life Extending Shutdown Mode and Adjustable Output

LDO Selection Guide

Part Number	Max. Input Voltage (V)	Output Voltage Options (V)								Adjustable (Max. Output) (V)	Output Accuracy (%)	Max. $V_{DROPOUT}$ @ I_{LOAD}	No Load Current (µA)	Reference Bypass	Shutdown Option	Standby Mode	Error Flag Output	Over Current Circuit Protection	Thermal Protection	Package
		2.5	2.7	2.85	3.0	3.3	3.6	4.0	5.0											
IMP2014	6.5	●	●	●	●	●	●	●			0.50	70mV@50mA	33	●	●			●	●	SOT-23A-5
IMP2015	6.5	●	●	●	●	●	●	●			0.50	160mV@100mA	33	●	●			●	●	SOT-23A-5
IMP2054	6.5	●	●	●	●	●	●	●			0.50	70mV@50mA	33		●		●	●	●	SOT-23A-5
IMP2055	6.5	●	●	●	●	●	●	●			0.50	160mV@100mA	33		●		●	●	●	SOT-23A-5
IMP2070	6.5									5.5		70mV@50mA	33		●			●	●	SOT-23A-5
IMP882*	11.5								●	11.5	5	640mV@200mA	11			●		●	●	8-pin, DIP and SO
IMP883*	11.5					●				11.5	5	240mV@200mA	11		●			●	●	8-pin, DIP and SO
IMP884*	11.5					●				11.5	5	640mV@200mA	11		●			●	●	8-pin, DIP and SO
IMP2071	6.5									5.5	0.50	160mV@100mA	33		●			●	●	SOT-23A-5
IMP2185	6.5	●	●	●	●	●	●	●			0.50	250mV@150mA	33	●				●	●	SOT-23A-5
IMP2186	6.5	●	●	●	●	●	●	●			0.50	250mV@150mA	33		●		●	●	●	SOT-23A-5
IMP2187	6.5									5.5	0.50	250mV@150mA	33		●			●	●	SOT-23A-5
IMP37	5.5	●			●	●					1	0.95V @ 0.8A	36					●	●	3-pin, SOT-223, 3-pin, TO-263

LDO_t02.eps

** The IMP882/3/4 are available with adjustable (A) and fixed (F) voltage outputs.*

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Low Dropout Positive Voltage Regulators

– 800mA
– 2.5V, 3.0V and 3.3V Output

The IMP37 series of Low Dropout (LDO) three-terminal voltage regulators feature guaranteed low dropout voltages at currents up to 0.8A. The IMP37 regulator family dropout voltage is guaranteed to be 0.95V or lower at 0.8A. At 100mA, the maximum dropout voltage is 0.8V. Compared with "1117" type LDOs, the IMP37 has a 20% lower dropout voltage.

Three fixed output voltages are offered: 2.5V, 3.0V and 3.3V. Output voltages are factory trimmed to within 1% of the nominal value.

In addition to low dropout voltages, the IMP37 family features greatly reduced quiescent operating current. The 75µA maximum specification represents an over 100 times improvement over competitive devices.

Devices are short circuit protected, and a thermal protection circuit shuts the regulator off should the junction temperature exceed 165°C.

The IMP37 is available in low-profile plastic SOT-223 and TO-263 packages and are pin compatible with fixed "1117" devices.

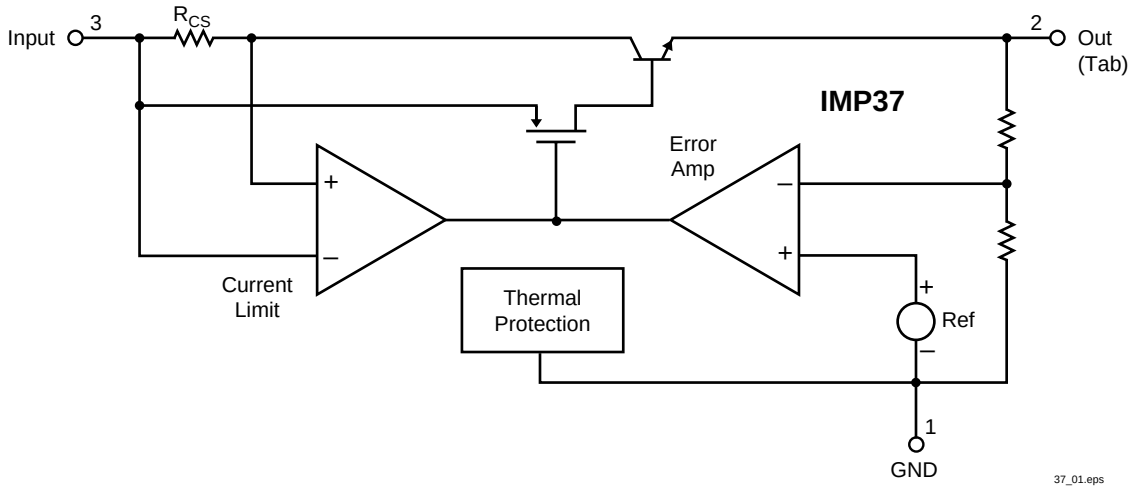
Key Features

- Low Dropout Voltage
  - 0.8V maximum at 100mA
  - 0.95V maximum at 800mA
  - 20% lower dropout voltage than "1117" LDO regulators
- Guaranteed Low Dropout Voltage at Multiple Current Levels
- 1% Trimmed 2.5V, 3.0V and 3.3V Outputs
- Reduced Quiescent Current: 75µA Maximum
- Short Circuit and Thermal Protection
- Space Saving SOT-223 Surface Mount Package
- "1117" Pin Compatible

Applications

- High-efficiency linear power supplies
- Post regulator for switching supplies
- 5V to 3.3V linear regulators
- USB hubs
- Battery chargers
- Routers, ISDN/DSL modems

Block Diagram



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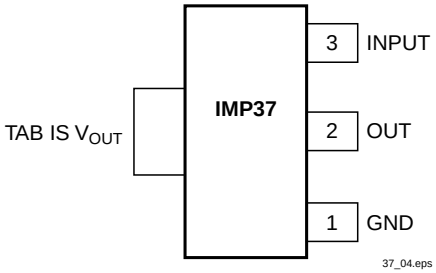
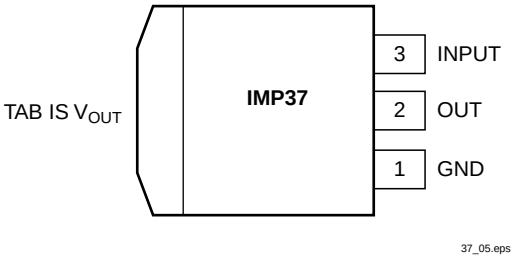
Pin Configuration

SOT-223



Front View

TO-263



Front View

Pin Descriptions

Pin Number	Name	Function
1	GND	Ground Pin
2	OUT	Output Voltage
3	INPUT	Input Voltage
TAB	TAB	Output Voltage

37_Table03.eps

Package Marking Code

Part Number	Package	Device Marking
IMP37-25JST	SOT-223	3725
IMP37-30JST	SOT-223	3730
IMP37-33JST	SOT-223	3733
IMP37-25JCM	TO-263	3725JCM
IMP37-30JCM	TO-263	3730JCM
IMP37-33JCM	TO-263	3733JCM

37_Table05.eps

Ordering Information

Output Options			Part Ordering Number	
Voltage	Maximum Quiescent Current	Dropout Voltage at 800mA	SOT-223 Package	TO-263 Package
2.5V	75µA	0.95V	IMP37-25JST	IMP37-25JCM
3.0V	75µA	0.95V	IMP37-30JST	IMP37-30JCM
3.3V	75µA	0.95V	IMP37-33JST	IMP37-33JCM

37_t06.eps

Note: Tape and reel shipping is available for the SOT-223 and TO-263 packages. Append the TAPE AND REEL designation "/T" to the ordering part number for tape and reel devices. For example, the IMP37-25JST/T is a 2.5V SOT-223 packaged device shipped in reels.

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Absolute Maximum Ratings

Input Voltage 7V
Operating Junction Temperature . . . . . 0°C to 150°C

Storage Temperature Range . . . . . –65°C to +150°C
Lead Temperature (Soldering) . . . . . 300°C for 10 seconds

These are stress ratings only and functional operation is not implied. Exposure to absolute maximum ratings for prolonged time periods may affect device reliability. All voltages are with respect to ground.

Electrical Characteristics

Specifications apply over the junction operating temperature range of T_J = 0°C to +125°C unless otherwise noted.

Parameter	Symbol	Suffix	Conditions	Min	Typ	Max	Units
Output Voltage	V_{OUT}	–25	I_{OUT} = 10mA, V_{IN} = 4.85V, T_J = 25°C	2.475	2.5	2.525	V
			10mA ≤ I_{OUT} ≤ I_{MAX}, 4.25V ≤ V_{IN} ≤ 5.5V	2.45	2.5	2.55	
		–30	I_{OUT} = 10mA, V_{IN} = 5V, T_J = 25°C	2.97	3.00	3.03	
			10mA ≤ I_{OUT} ≤ I_{MAX}, 4.75V ≤ V_{IN} ≤ 5.5V	2.94	3.00	3.06	
		–33	I_{OUT} = 10mA, V_{IN} = 5V, T_J = 25°C	3.267	3.30	3.333	
			10mA ≤ I_{OUT} ≤ I_{MAX}, 4.75V ≤ V_{IN} ≤ 5.5V	3.235	3.30	3.365	
Line Regulation (Note 1)		–25	I_{OUT} = 10mA, 4.25V ≤ (V_{IN}) ≤ 5.5V		12	19	mV
		–30	I_{OUT} = 10mA, 4.5V ≤ V_{IN} ≤ 5.5V		12	19	
		–33	I_{OUT} = 10mA, 4.5V ≤ V_{IN} ≤ 5.5V		12	19	
Line Regulation (Note 1)		–25	I_{OUT} = 10mA, 4.25V ≤ (V_{IN}) ≤ 5.5V, T_A = 25°C		2.8	4.3	mV
		–30	I_{OUT} = 10mA, 4.5V ≤ V_{IN} ≤ 5.5V, T_A = 25°C		2.8	4.3	
		–33	I_{OUT} = 10mA, 4.5V ≤ V_{IN} ≤ 5.5V, T_A = 25°C		2.8	4.3	
Load Regulation (Note 1)		–25	V_{IN} = 4.25V, 5mA ≤ I_{OUT} ≤ 800mA		25	30	mV
		–30	V_{IN} = 4.75V, 5mA ≤ I_{OUT} ≤ 800mA		25	30	
		–33	V_{IN} = 4.75V, 5mA ≤ I_{OUT} ≤ 800mA		25	30	
Dropout Voltage (Note 2)		–xx	I_{OUT} = 100mA			0.8	V
			I_{OUT} = 800mA			0.95	
Current Limit	$I_{OUT(MAX)}$	–xx	T_J = 25°C	800	950	1200	mA
Minimum Load Current		–xx				5.0	mA
Quiescent Current	I_Q	–xx	V_{IN} ≤ 6V		36	75	µA
Thermal Regulation			T_A = 25°C, 30ms Pulse		0.01	0.1	%/W
Ripple Rejection			f_{RIPPLE} = 120Hz, V_{IN} = 5V, T_A = 25°C V_{RIPPLE} = 1Vp-p, I_{LOAD}= 10mA	51	54		dB
Temperature Stability					0.5		%
Long Term Stability			T_A = 125°C, 1000 Hrs		0.3		%
RMS Output Noise			(% of V_{OUT}), 10Hz ≤ f ≤ 10kHz, T_J = 25°C		0.003		%
Thermal Resistance			Junction-to-Case at TAB (TO-223)		15		°C/W
			Junction-to-Case at TAB (TO-263)		10		

37_t07.eps

Notes: 1. *See thermal regulation specification for changes in output voltage due to heating effects. Load regulation and line regulation are measured with low duty cycle pulse testing to maintain a constant junction temperature.*

2. *Dropout voltage is specified over the full output current range. Dropout voltage is defined as the minimum input/output differential measured at the specified output current.*

3. *Minimum load current is defined as the minimum output current required to maintain regulation.*

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Application Information

The IMP37 voltage regulator ICs offer self-protection features which include short-circuit current protection and automatic thermal shutdown (for junction temperature above 165°C).

Circuit Stability

Like all regulators, an output filter capacitor is required for circuit stability. Besides smoothing the output, the output capacitor "completes" the regulator's frequency compensation. The ESR of the output capacitor should be less than 0.5Ω. Low ESR capacitors are preferred.

Table 1 shows recommended minimum capacitance values for both aluminum and tantalum capacitors. Larger values of output capacitance do not cause stability problems.

Table 1. Recommended Output Bypass Capacitors

Output Bypass Capacitor (ESR < 0.5Ω)
10µF Tantalum, 100µF Aluminum

An input bypass capacitor is recommended. A 10µF or larger tantalum capacitor is suitable for most applications.

Thermal Management

The maximum operating junction temperature for the IMP37 devices is 150°C. The junction temperature can be calculated when the power dissipation and ambient temperature are known with this equation: $T_J = T_A + (P_D \times \Theta_{JA})$.

The thermal resistance from juntion-to-ambient (Θ_{JA}) is the sum of the three thermal resistances:

$$\Theta_{JA} = \Theta_{JT} + \Theta_{TS} + \Theta_{SA}$$

Where Θ_{JT} = Junction-to-Tab thermal resistance

Θ_{TS} = Tab-to-Heat Sink thermal resistance

Θ_{SA} = Heat Sink-to-Air thermal resistance

Table 2. Thermal Resistance of Packages

Package Type	Thermal Resistance
	Junction to Tab, Θ_{JT}
SOT-223	15°C/W
TO-263	10°C/W

The IMP37 series devices have thermal limiting circuitry to protect the device from over current. For continuous operation, the maximum junction temperature rating must not be exceeded.

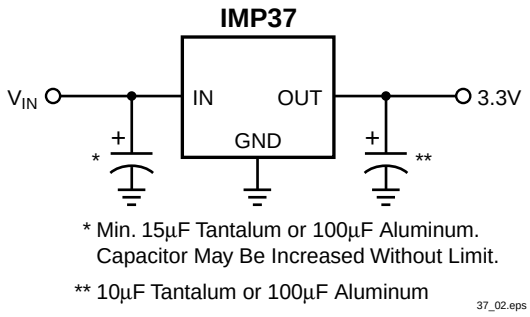

Figure 1. Fixed 3.3V Regulator

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60mA/110mA/160mA Super Low Dropout CMOS Regulators with Battery Life Extending Shutdown Mode

The IMP2014, IMP2015 and IMP2185 high performance CMOS low dropout voltage regulators offer superior dropout voltage performance and load regulation characteristics as compared to the pin compatible TC1014/1015/1185 devices offered by TelCom Semiconductor. Dropout voltage performance has been improved by up to 40%.

Load regulation and power supply PSRR have been optimized. Load regulation is typically 0.32% and PSRR is 53dB at 1kHz.

A logic input controlled shutdown mode extends system battery life by reducing quiescent current to 0.2µA maximum. The shutdown mode can be initiated by a system microcontroller.

The regulators were designed with ease of use and stability in mind. Stability is guaranteed for 0.47µF and greater load capacitors with an ESR up to 5Ω. Ceramic or tantalum capacitors can be used.

Three devices with different guaranteed output current specifications are available: IMP2014 (60mA), IMP2015 (110mA) and IMP2185 (160mA). Each device has output voltage options of 2.5V, 2.7V, 2.85V, 3.0V, 3.3V, 3.6V and 4.0V.

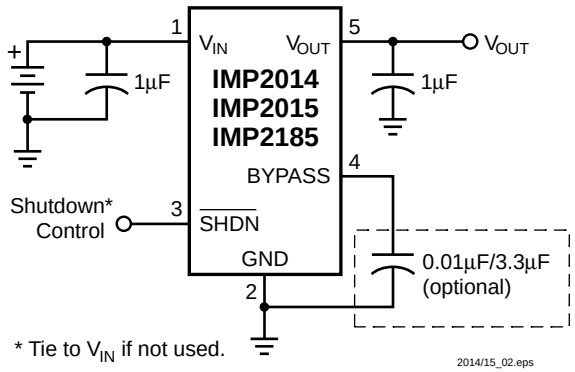
Key Features

- Pin Compatible with TelCom TC1014/1015/1185
- Lower Dropout Voltage for Long Battery Life
  - IMP2014: 70mV vs. TelCom TC1014 120mV
  - IMP2015: 160mV vs. TelCom TC1015 250mV
  - IMP2185: 250mV vs. TelCom TC1185 400mV
- Power Saving Shutdown Mode
  - 0.2µA shutdown current
- Superior Load Regulation
  - 0.32%
- Long Battery Life
  - 33µA no load ground current
- Accurate Output Voltage
  - ± 2.5% over temperature
- Low Drift Output: 40ppm/°C
- Guaranteed Minimum Output Current
  - IMP2014: 60mA
  - IMP2015: 110mA
  - IMP2185: 160mA
- Over-Current and Over-Temperature Protection
- Reference Bypass Input for Low-noise and Improved PSRR
- Compact SOT-23A-5 Package

Applications

- Pagers
- Cellular/GSM/PHS Phones
- Instrumentation
- Wireless Terminals
- Battery Powered Systems
- Medical Instruments
- Linear Post-Regulators

Typical Application



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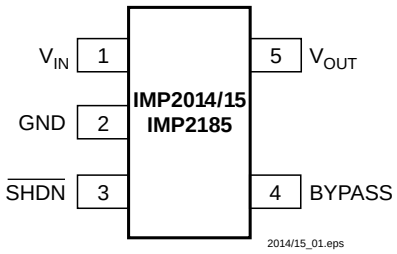
Pin Configuration

SOT-23A



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Pin Descriptions

Pin Number	Name	Function
1	V_{IN}	Unregulated supply input.
2	GND	Ground terminal.
3	$\overline{SHDN}$	Shutdown control input. A shutdown mode is entered when $\overline{SHDN}$ is a logic LOW. During shutdown the output voltage falls to 0V and quiescent current drops to 2.0µA.
4	BYPASS	Reference bypass input. A capacitor connected from the BYPASS pin to ground reduces the noise present on the internal reference and enhances PSRR
5	V_{OUT}	Output voltage

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Ordering Information

Part Number*	Package	Output Voltage (V)	Output Current (mA)	Shutdown Pin	Adjust Pin	OKAY Flag Output	Reference Bypass Pin	Package Marking A	B	C	D
IMP2014-2.5JUK/T	SOT23A-5	2.5	60	●			●	M	A	x	x
IMP2014-2.7JUK/T	SOT23A-5	2.7	60	●			●	M	B	x	x
IMP2014-2.85JUK/T	SOT23A-5	2.85	60	●			●	M	C	x	x
IMP2014-3.0JUK/T	SOT23A-5	3.0	60	●			●	M	D	x	x
IMP2014-3.3JUK/T	SOT23A-5	3.3	60	●			●	M	E	x	x
IMP2014-3.6JUK/T	SOT23A-5	3.6	60	●			●	M	F	x	x
IMP2014-4.0JUK/T	SOT23A-5	4.0	60	●			●	M	G	x	x
IMP2015-2.5JUK/T	SOT23A-5	2.5	110	●			●	O	A	x	x
IMP2015-2.7JUK/T	SOT23A-5	2.7	110	●			●	O	B	x	x
IMP2015-2.85JUK/T	SOT23A-5	2.85	110	●			●	O	C	x	x
IMP2015-3.0JUK/T	SOT23A-5	3.0	110	●			●	O	D	x	x
IMP2015-3.3JUK/T	SOT23A-5	3.3	110	●			●	O	E	x	x
IMP2015-3.6JUK/T	SOT23A-5	3.6	110	●			●	O	F	x	x
IMP2015-4.0JUK/T	SOT23A-5	4.0	110	●			●	O	G	x	x
IMP2185-2.5JUK/T	SOT23A-5	2.5	160	●			●	X	A	x	x
IMP2185-2.7JUK/T	SOT23A-5	2.7	160	●			●	X	B	x	x
IMP2185-2.85JUK/T	SOT23A-5	2.85	160	●			●	X	C	x	x
IMP2185-3.0JUK/T	SOT23A-5	3.0	160	●			●	X	D	x	x
IMP2185-3.3JUK/T	SOT23A-5	3.3	160	●			●	X	E	x	x
IMP2185-3.6JUK/T	SOT23A-5	3.6	160	●			●	X	F	x	x
IMP2185-4.0JUK/T	SOT23A-5	4.0	160	●			●	X	G	x	x

xx = Date Code * /T indicates Tape and Reel

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Absolute Maximum Ratings

Input Voltage 7V
Output Voltage . . . . . –0.3V to V_{IN} + 0.3V
Maximum Voltage on Any Pin . . . . . –0.3V to (V_{IN} + 0.3V)
Shutdown Voltage ($\overline{SHDN}$) . . . . . $\overline{SHDN} \le V_{IN}$ + 0.3V

These are stress ratings only and functional operation is not implied. Exposure to absolute maximum ratings for prolonged time periods may affect device reliability. All voltages are with respect to ground.

Operating Junction Temperature Range . . . – 40°C < T_J < 125°C
Storage Temperature . . . . . – 65°C to 150°C
Power Dissipation . . . . . Internally limited

Note: T_J = Junction Temperature, T_A = Ambient Temperature

Electrical Characteristics

$V_{IN} = V_{OUT}$ +1V, I_L = 100µA, C_L = 1µF, $\overline{SHDN} > V_{IH}$, T_A = 25°C, unless otherwise noted. **Bold/blue** specifications apply for junction temperature range –40°C < T_J < 125°C.

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Input Voltage Range	V_{IN}	0°C < T_J < 125°C			**6.50**	V
		–40°C < T_J < 125°C			**6.50**	
Maximum Output Current	I_{OMAX}	IMP2014	**60**			mA
		IMP2015	**110**			
		IMP2185	**160**			
Fixed Output Voltage	V_{OUT}	Note 1	**V_R – 2.5%**	V_R ± 0.5%	**V_R + 2.5%**	V
Dropout Voltage (Note 2)	V_{IN} - V_O	I_L = 100µA		1		mV
		I_L = 20mA		17	**23**	
		I_L = 50mA		60	**70**	
		I_L = 100mA (IMP2015, IMP2185)		90	**160**	
		I_L = 150mA (IMP2185)		143	**250**	
Quiescent Current (Ground Current)		No load		33	**50**	µA
Shutdown Supply Current	I_{INSD}	$\overline{SHDN}$ = 0V $T_J \le$ 25°C		0.2	2	µA
Output Temperature Coefficient				40		ppm/°C
Thermal Regulation				0.04		%/W
Line Regulation		V_R + 1V ≤ V_{IN} ≤ 6V		0.0375	**0.35**	%

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Notes: 1. V_R is the regulated output voltage: 2.5V, 2.7V, 2.85V, 3.0V, 3.3V, 3.6V or 4.0V.
2. Dropout Voltage is defined as the difference between IN and OUT when V_R drops 2% below its nominal value.
3. Specifications which would otherwise be affected by self-heating of the die are tested at a constant die temperature by using low duty cycle pulse testing.
3. PSRR guaranteed by design.

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Electrical Characteristics

$V_{IN} = V_{OUT}$ +1V, I_L = 100µA, C_L = 1µF, $\overline{SHDN} > V_{IH}$, T_A = 25°C, unless otherwise noted. **Bold/blue** specifications apply for junction temperature range of –40°C < T_J < 125°C.

Parameter	Symbol	Conditions		Min	Typ	Max	Units
Load Regulation:							
IMP2014		I_L = 100µA to 50mA			0.11	**0.5**	%
IMP2015		I_L = 100µA to 100mA			0.16	**1.0**	
IMP2185		I_L = 100µA to 150mA			0.65	**1.5**	
Thermal Shutdown Die Temperature					150		°C
Thermal Shutdown Hysteresis					12		°C
Ripple Rejection	PSRR	$V_{IN} \geq (V_O + 1V) \pm 0.25V$ C_O = 3.3µF ceramic C_{BYPASS} = 0.01µF	Freq. = 1kHz		60		dB
			Freq. = 10kHz		47		
			Freq. = 1MHz		34		
Output Noise		300Hz to 50kHz No bypass capacitor I_L = 50mA (IMP2014) I_L = 100mA			280		μV_{RMS}
		300Hz to 50kHz C_{BYPASS} = 0.01µF I_L = 50mA (IMP2014) I_L = 100mA			60		μV_{RMS}
$\overline{SHDN}$ Input HIGH Threshold		2.5V ≤ V_{IN} ≤ 6.5V		**45**			% of V_{IN}
$\overline{SHDN}$ Input LOW Threshold		2.5V ≤ V_{IN} ≤ 6.5V				**15**	% of V_{IN}
Reverse Current into V_{OUT}		$V_{(IN)} < V_{(OUT)}$ $\overline{SHDN}$ = HIGH = V_{IN}			2.0		mA
		$V_{(IN)} < V_{(OUT)}$ $\overline{SHDN}$ = LOW			2.7		µA
Output Current Limit					350	**600**	mA

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Notes: 1. *V_R is the regulated output voltage: 2.5V, 2.7V, 2.85V, 3.0V, 3.3V, 3.6V or 4.0V.*

2. *Dropout Voltage is defined as the difference between IN and OUT when V_R drops 2% below its nominal value.*

3. *Specifications which would otherwise be affected by self-heating of the die are tested at a constant die temperature by using low duty cycle pulse testing.*

4. *PSRR guaranteed by design.*

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Typical Characteristics

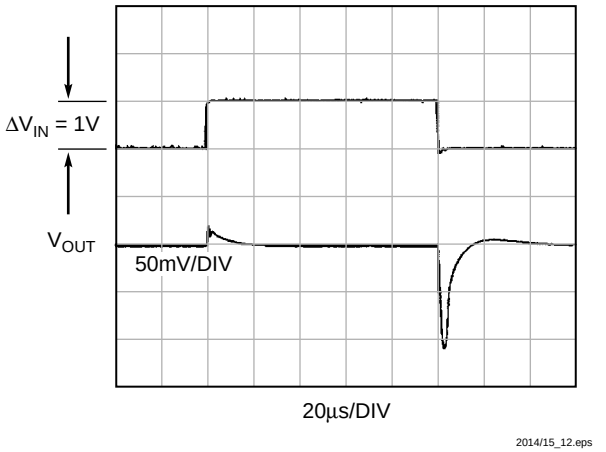

Figure 1. Line Transient Response

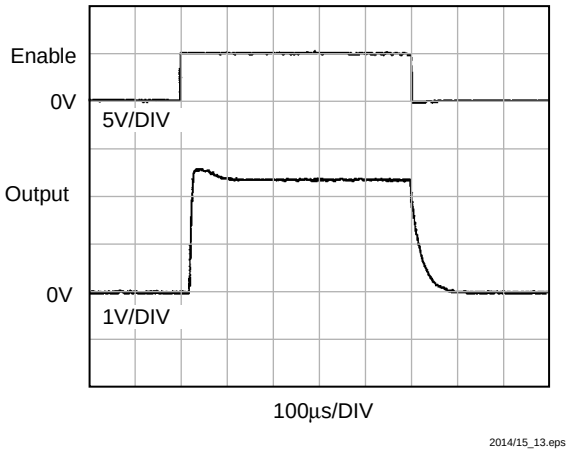

Figure 2. Enable Input Response

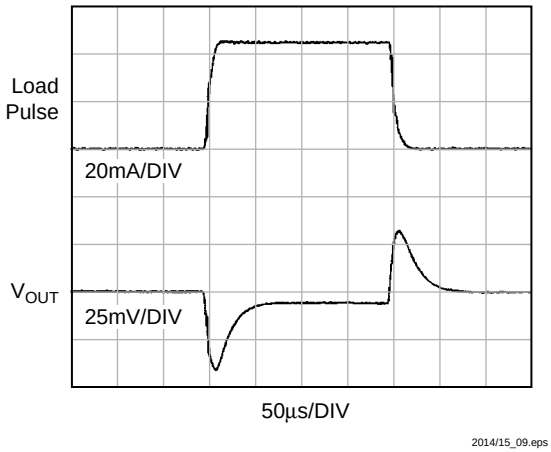

Figure 3. Load Transient Response (50mA Step)

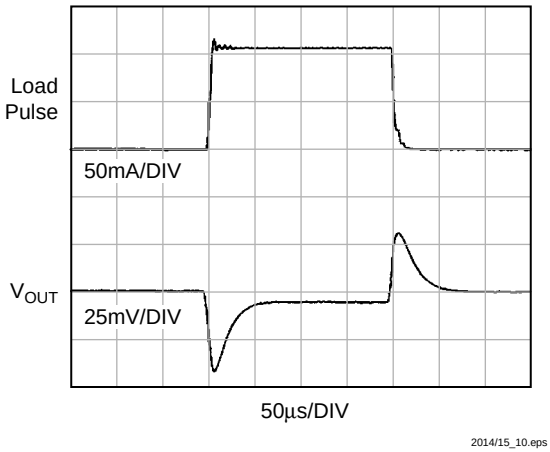

Figure 4. Load Transient Response (100mA Step)

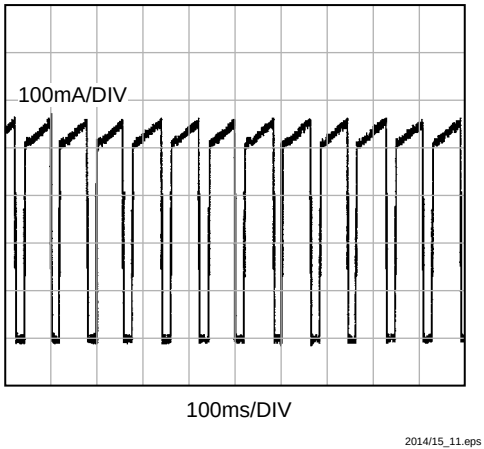

Figure 5. Output Short Circuit Response

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Application Information

The IMP2014, IMP2015 and IMP2185 have been designed to offer exceptionally low dropout voltage, superior load regulation and minimum quiescent power.

Shutdown Mode

A battery-life-extending mode is available. Through the active LOW shutdown pin, $\overline{SHDN}$, the regulator can be enabled or turned off. The regulator is shutdown (turned off) when SHDN is LOW and enabled (turned on) when $\overline{SHDN}$ is HIGH.

The shutdown signal can be supplied from a CMOS gate or from an I/O port of a microcontroller.

During shutdown, the output voltage falls to 0V and the supply current is typically only 200nA.

If the shutdown mode is not needed, $\overline{SHDN}$ should be connected directly to the regulator input voltage pin.

Output Capacitor

The IMP2014, IMP2015 and IMP2185 were designed for stable operation with a wide range of capacitor values and type. The output capacitor should be above 0.47µF. A 1µF value is recommended. Ceramic or tantalum capacitors are suitable with an ESR of up to 5Ω.

Reference Voltage Bypass Capacitor

For low noise operation a 0.01µF or larger capacitor can be connected from the BYPASS pin to ground. For maximum power supply rejection/line rejection, a 3.3µF value is suggested.

The IMP2014/2015/2185 were designed so that line regulation and ripple rejection would be maximized. This was accomplished by powering the internal bandgap reference from an internal regulated source. This "pre-regulation" greatly improves power supply regulation for input voltages greater than that of the internal voltage regulator, 3.5V.

Thermal Shutdown

An on-chip thermal protection circuit shuts the LDO regulator off when the die temperature exceeds 150°C. There is a built in 12°C hysteresis. The regulator will remain off until the die temperature drops to approximately to 138°C.

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60mA/110mA/160mA Super Low Dropout CMOS Regulators with Battery Life Extending Shutdown Mode and $\overline{\text{ERROR}}$ Output

The IMP2054, IMP2055 and IMP2186 high performance CMOS low dropout voltage regulators offer superior dropout voltage performance and load regulation characteristics as compared to the pin compatible TC1054/1055/1186 devices offered by TelCom Semiconductor. Dropout voltage performance has been improved by up to 40%.

Load regulation and power supply PSRR have been optimized. Load regulation is typically 0.32% and PSRR is 53dB at 1kHz.

A logic input controlled shutdown mode extends system battery life by reducing quiescent current to 0.2µA maximum. The shutdown mode can be initiated by a system microcontroller.

The regulators were designed with ease of use and stability in mind. Stability is guaranteed for 0.47µF and greater load capacitors with an ESR up to 5Ω. Ceramic or tantalum capacitors can be used.

Three devices with different guaranteed output current specifications are available: IMP2054 (60mA), IMP2055 (110mA) and IMP2186 (160mA). Each device has output voltage options of 2.5V, 2.7V, 2.85V, 3.0V, 3.3V, 3.6V and 4.0V.

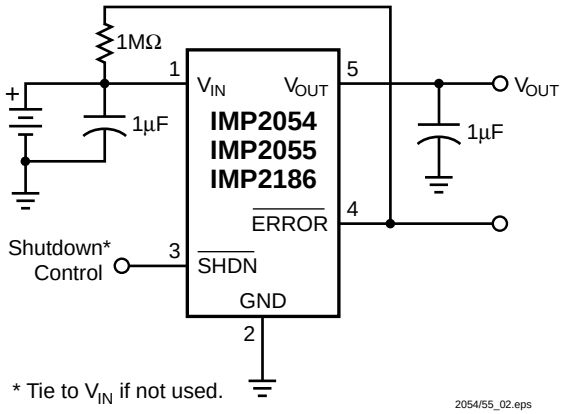
Key Features

- Pin Compatible with TelCom TC1054/1055/1186
- Lower Dropout Voltage for Long Battery Life
  - IMP2054: 70mV vs. TelCom TC1054 120mV
  - IMP2055: 160mV vs. TelCom TC1055 250mV
  - IMP2186: 250mV vs. TelCom TC1186 400mV
- Power Saving Shutdown Mode
  - 0.2µA shutdown current
- $\overline{\text{ERROR}}$ Output
  - Low battery detection
  - Processor reset
- Superior Load Regulation
  - 0.32%
- Long Battery Life
  - 33µA no load ground current
- Accurate Output Voltage
  - ± 2.5% over temperature
- Low Drift Output: 40ppm/°C
- Guaranteed Minimum Output Current
  - IMP2054: 60mA
  - IMP2055: 110mA
  - IMP2186: 160mA
- Over-Current and Over-Temperature Protection
- Compact SOT-23A-5 Package

Applications

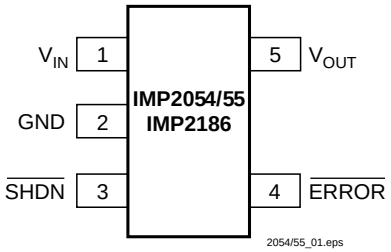
- Pagers
- Cellular/GSM/PHS Phones
- Instrumentation
- Wireless Terminals
- Battery Powered Systems
- Medical Instruments
- Linear Post-Regulators

Typical Application



Pin Configuration

SOT-23A



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Pin Descriptions

Pin Number	Name	Function
1	V_{IN}	Unregulated supply input.
2	GND	Ground terminal.
3	$\overline{SHDN}$	Shutdown control input. A shutdown mode is entered when $\overline{SHDN}$ is a logic LOW. During shutdown the output voltage falls to 0V and quiescent current drops to 2.0µA.
4	$\overline{ERROR}$	Out-of-Regulation Flag output. An open drain output that goes LOW when the output is out-of-tolerance by approximately 5%.
5	V_{OUT}	Output voltage

2054/55_t01.eps

Ordering Information

Part Number*	Package	Output Voltage (V)	Output Current (mA)	Shutdown Pin	Adjust Pin	ERROR Flag Output	Reference Bypass Pin	Package Marking			
								A	B	C	D
IMP2054-2.5JUK/T	SOT23A-5	2.5	60	●		●		R	A	x	x
IMP2054-2.7JUK/T	SOT23A-5	2.7	60	●		●		R	B	x	x
IMP2054-2.85JUK/T	SOT23A-5	2.85	60	●		●		R	C	x	x
IMP2054-3.0JUK/T	SOT23A-5	3.0	60	●		●		R	D	x	x
IMP2054-3.3JUK/T	SOT23A-5	3.3	60	●		●		R	E	x	x
IMP2054-3.6JUK/T	SOT23A-5	3.6	60	●		●		R	F	x	x
IMP2054-4.0JUK/T	SOT23A-5	4.0	60	●		●		R	G	x	x
IMP2055-2.5JUK/T	SOT23A-5	2.5	110	●		●		T	A	x	x
IMP2055-2.7JUK/T	SOT23A-5	2.7	110	●		●		T	B	x	x
IMP2055-2.85JUK/T	SOT23A-5	2.85	110	●		●		T	C	x	x
IMP2055-3.0JUK/T	SOT23A-5	3.0	110	●		●		T	D	x	x
IMP2055-3.3JUK/T	SOT23A-5	3.3	110	●		●		T	E	x	x
IMP2055-3.6JUK/T	SOT23A-5	3.6	110	●		●		T	F	x	x
IMP2055-4.0JUK/T	SOT23A-5	4.0	110	●		●		T	G	x	x
IMP2186-2.5JUK/T	SOT23A-5	2.5	160	●		●		Y	A	x	x
IMP2186-2.7JUK/T	SOT23A-5	2.7	160	●		●		Y	B	x	x
IMP2186-2.85JUK/T	SOT23A-5	2.85	160	●		●		Y	C	x	x
IMP2186-3.0JUK/T	SOT23A-5	3.0	160	●		●		Y	D	x	x
IMP2186-3.3JUK/T	SOT23A-5	3.3	160	●		●		Y	E	x	x
IMP2186-3.6JUK/T	SOT23A-5	3.6	160	●		●		Y	F	x	x
IMP2186-4.0JUK/T	SOT23A-5	4.0	160	●		●		Y	G	x	x

xx = Date Code * /T indicates Tape and Reel

2054/55_t03.eps

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Absolute Maximum Ratings

Input Voltage 7V
Output Voltage . . . . . –0.3V to V_{IN} + 0.3V
Maximum Voltage on Any Pin . . . . . –0.3V to (V_{IN} + 0.3V)
Shutdown Voltage ($\overline{SHDN}$) . . . . . $\overline{SHDN} \le V_{IN}$ + 0.3V

These are stress ratings only and functional operation is not implied. Exposure to absolute maximum ratings for prolonged time periods may affect device reliability. All voltages are with respect to ground.

Operating Junction Temperature Range . . . – 40°C < T_J < 125°C
Storage Temperature . . . . . – 65°C to 150°C
Power Dissipation . . . . . Internally limited

Note: T_J = Junction Temperature, T_A = Ambient Temperature

Electrical Characteristics

$V_{IN} = V_{OUT}$ +1V, I_L = 100µA, C_L = 1µF, $\overline{SHDN} > V_{IH}$, T_A = 25°C, unless otherwise noted. **Bold/blue** specifications apply for junction temperature range –40°C < T_J < 125°C.

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Input Voltage Range	V_{IN}	0°C < T_J < 125°C			**6.50**	V
		–40°C < T_J < 125°C			**6.50**	
Maximum Output Current	I_{OMAX}	IMP2054	**60**			mA
		IMP2055	**110**			
		IMP2186	**160**			
Fixed Output Voltage	V_{OUT}	Note 1	**V_R – 2.5%**	V_R ± 0.5%	**V_R + 2.5%**	V
Dropout Voltage (Note 2)	V_{IN} - V_O	I_L = 100µA		1		mV
		I_L = 20mA		17	**23**	
		I_L = 50mA		60	**70**	
		I_L = 100mA (IMP2054, IMP2186)		90	**160**	
		I_L = 150mA (IMP2186)		143	**250**	
Quiescent Current (Ground Current)		No load		33	**50**	µA
Shutdown Supply Current	I_{INSD}	$\overline{SHDN}$ = 0V $T_J \le$ 25°C		0.2	2	µA
Output Temperature Coefficient				40		ppm/°C
Thermal Regulation				0.04		%/W
Line Regulation		V_R + 1V ≤ V_{IN} ≤ 6V		0.0375	**0.35**	%

2054/55_t02a.eps

Notes: 1. V_R is the regulated output voltage: 2.5V, 2.7V, 2.85V, 3.0V, 3.3V, 3.6V or 4.0V.
2. Dropout Voltage is defined as the difference between IN and OUT when V_R drops 2% below its nominal value.
3. Specifications which would otherwise be affected by self-heating of the die are tested at a constant die temperature by using low duty cycle pulse testing.
3. PSRR guaranteed by design.

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Electrical Characteristics

$V_{IN} = V_{OUT}$ +1V, I_L = 100µA, C_L = 1µF, $\overline{SHDN} > V_{IH}$, T_A = 25°C, unless otherwise noted. **Bold/blue** specifications apply for junction temperature range of –40°C < T_J < 125°C.

Parameter	Symbol	Conditions		Min	Typ	Max	Units
Load Regulation:							
IMP2054		I_L = 100µA to 50mA			0.32	**2.0**	%
IMP2055		I_L = 100µA to 100mA			0.32	**2.0**	
IMP2186		I_L = 100µA to 150mA			0.32	**3.0**	
Thermal Shutdown Die Temperature					150		°C
Thermal Shutdown Hysteresis					12		°C
Ripple Rejection	PSRR	$V_{IN} \geq (V_O + 1V) \pm 0.25V$ C_O = 3.3µF ceramic	Freq. = 1kHz		58		dB
			Freq. = 10kHz		45		
			Freq. = 1MHz		34		
Output Noise		300Hz to 50kHz I_L = 50mA (IMP2054) I_L = 100mA			280		μV_{RMS}
$\overline{SHDN}$ Input HIGH Threshold		2.5V ≤ V_{IN} ≤ 6.5V		**45**			% of V_{IN}
$\overline{SHDN}$ Input LOW Threshold		2.5V ≤ V_{IN} ≤ 6.5V				**15**	% of V_{IN}
$\overline{ERROR}$ Flag Minimum Supply Voltage				1.5			V
$\overline{ERROR}$ Flag Threshold Voltage		V_{TH}			$0.95V_R$		V
$\overline{ERROR}$ Flag Hysteresis		V_{HYS}			50		mV
$\overline{ERROR}$ Flag Output Low Voltage		$I_{\overline{ERROR}}$ = 1mA			75	**400**	mV
Reverse Current into V_{OUT}		$V_{(IN)} < V_{(OUT)}$ $\overline{SHDN}$ = HIGH = V_{IN}			2.0		mA
		$V_{(IN)} < V_{(OUT)}$ $\overline{SHDN}$ = LOW			2.7		µA
Output Current Limit					350	**600**	mA

2054/55_t02b.eps

Notes: 1. *V_R is the regulated output voltage: 2.5V, 2.7V, 2.85V, 3.0V, 3.3V, 3.6V or 4.0V.*
2. *Dropout Voltage is defined as the difference between IN and OUT when V_R drops 2% below its nominal value.*
3. *Specifications which would otherwise be affected by self-heating of the die are tested at a constant die temperature by using low duty cycle pulse testing.*
4. *PSRR guaranteed by design.*

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Typical Characteristics

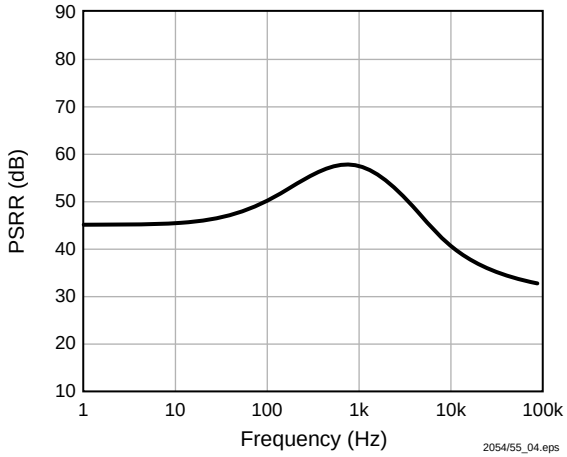

Figure 1. IMP2055 PSRR at I_{LOAD} = 100mA

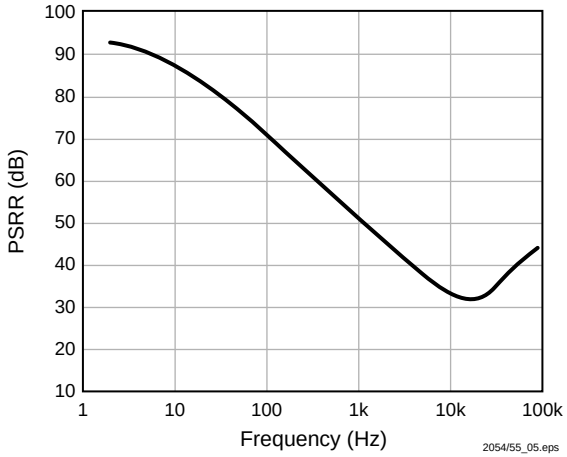

Figure 2. IMP2055 PSRR at I_{LOAD} = 1mA

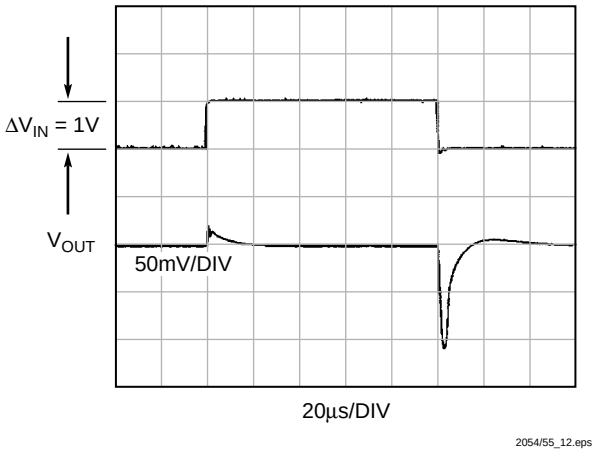

Figure 3. Line Transient Response

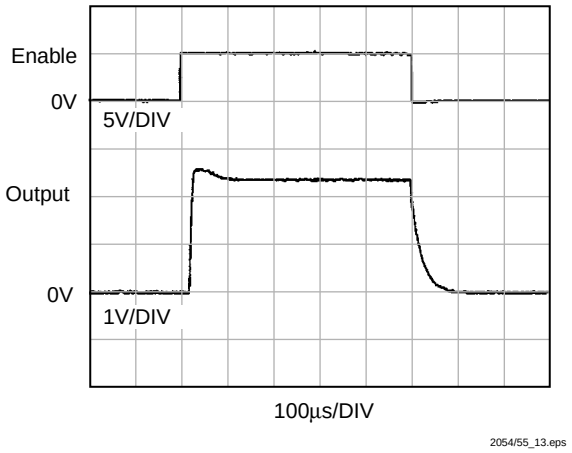

Figure 4. Enable Input Response

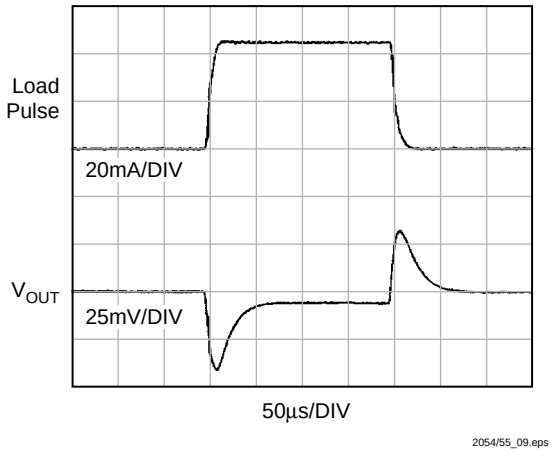

Figure 5. Load Transient Response (50mA Step)

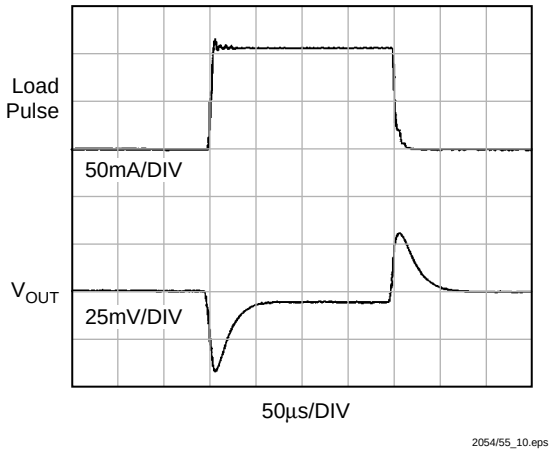

Figure 6. Load Transient Response (100mA Step)

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Typical Characteristics

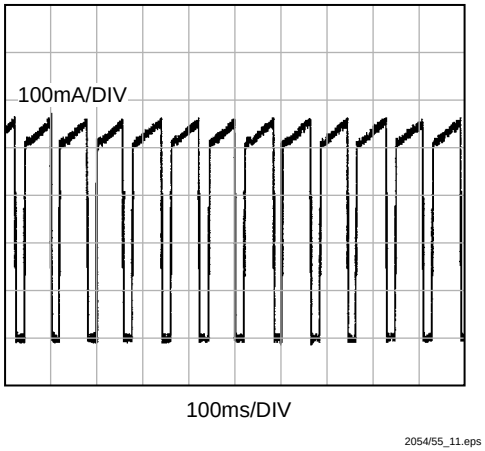

Figure 7. Output Short Circuit Response

Application Information

The IMP2054, IMP2055 and IMP2186 have been designed to offer exceptionally low dropout voltage, superior load regulation and minimum quiescent power.

Shutdown Mode

A battery-life-extending mode is available. Through the active LOW shutdown pin, $\overline{SHDN}$, the regulator can be enabled or turned off. The regulator is shutdown (turned off) when $\overline{SHDN}$ is LOW and enabled (turned on) when $\overline{SHDN}$ is HIGH.

The shutdown signal can be supplied from a CMOS gate or from an I/O port of a microcontroller.

During shutdown, the output voltage falls to 0V and the supply current is typically only 200nA.

If the shutdown mode is not needed, $\overline{SHDN}$ should be connected directly to the regulator input voltage pin.

$\overline{ERROR}$ Open Drain Output

$\overline{ERROR}$ is driven low whenever V_{OUT} falls out of regulation by more than 5 percent typically. This condition may be caused by low input voltage, output current limiting, or thermal limiting. The $\overline{ERROR}$ threshold is 5% below rated V_{OUT} regardless of the programmed output voltage value (e.g. $\overline{ERROR}$ = V_{OL} at 4.7V (typical) for a 5.0V regulator and 2.85V (typical) for a 3.0V regulator). $\overline{ERROR}$ output operation is shown in *Figure 8*.

Note that $\overline{ERROR}$ is active when V_{OUT} falls to V_{TH}, and inactive when V_{OUT} rises above V_{TH} by V_{HYS}.

As shown in *Figure 9*, $\overline{ERROR}$ can be used as a battery low flag, or as a microcontroller $\overline{RESET}$ signal (with the addition of timing capacitor C2). R1 x C2 should be chosen to maintain $\overline{ERROR}$ below V_{IH} of the processor $\overline{RESET}$ input for at least 200ms to allow time for the system to stabilize.

Output Capacitor

The IMP2054, IMP2055 and IMP2186 were designed for stable operation with a wide range of capacitor values and type. The output capacitor should be above 0.47µF. A 1µF value is recommended. Ceramic or tantalum capacitors are suitable with an ESR up to 5Ω.

Thermal Shutdown

An on-chip thermal protection circuit shuts the LDO regulator off when the die temperature exceeds 150°C. There is a built in 12°C hysteresis. The regulator will remain off until the die temperature drops to approximately to 138°C.

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Application Information

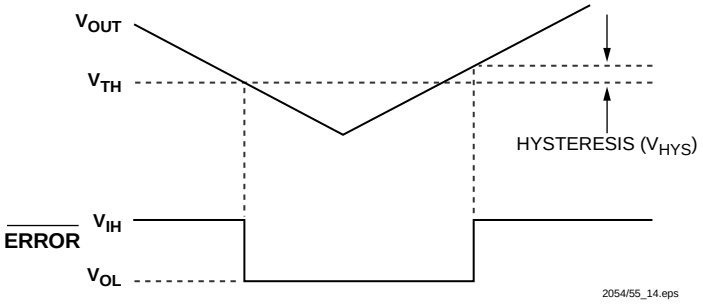

Figure 8. $\overline{\text{ERROR}}$ Output Operation

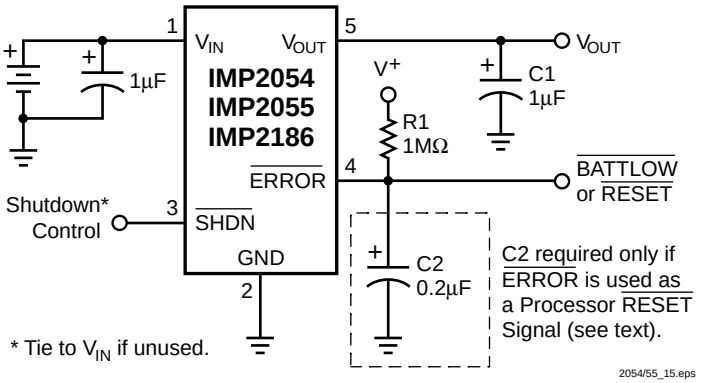

Figure 9. Typical Application Circuit

Notes

Project

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60mA/110mA/160mA Super Low Dropout CMOS Regulators with Battery Life Extending Shutdown Mode and Adjustable Output

The IMP2070, IMP2071 and IMP2187 feature an adjustable output voltage. Compared to the pin compatible TC1070/1071/1187 devices offered by TelCom Semiconductor. Dropout voltage performance has been improved by up to 40%.

Load regulation and power supply PSRR have been optimized. Load regulation is typically 0.32% and PSRR is 53dB at 1kHz.

A logic input controlled shutdown mode extends system battery life by reducing quiescent current to 0.2µA maximum. The shutdown mode can be initiated by a system microcontroller.

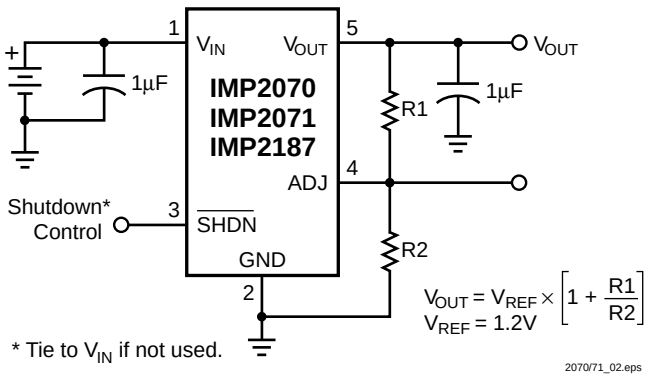
The regulators were designed with ease of use and stability in mind. Stability is guaranteed for 0.47µF and greater load capacitors with an ESR up to 5Ω. Ceramic or tantalum capacitors can be used.

Three devices with different guaranteed output current specifications are available: IMP2070 (60mA), IMP2071 (110mA) and IMP2187 (160mA).

Key Features

- Pin Compatible with TelCom TC1070/1071/1187
- Lower Dropout Voltage For Long Battery Life
  - IMP2070: 70mV vs. TelCom TC1070 120mV
  - IMP2071: 160mV vs. TelCom TC1071 250mV
  - IMP2187: 250mV vs. TelCom TC1187 400mV
- Power Saving Shutdown Mode
  - 0.2µA shutdown current
- Adjustable Output Voltage
- Superior Load Regulation
  - 0.32%
- Long Battery Life
  - 33µA no load ground current
- Accurate Output Voltage
  - ± 2.5% over temperature
- Low Drift Output: 40ppm/°C
- Guaranteed Minimum Output Current
  - IMP2070: 60mA
  - IMP2071: 110mA
  - IMP2187: 160mA
- Over-Current and Over-Temperature Protection
- Compact SOT-23A-5 Package

Typical Application



Applications

- Pagers
- Cellular/GSM/PHS Phones
- Instrumentation
- Wireless Terminals
- Battery Powered Systems
- Medical Instruments
- Linear Post-Regulators

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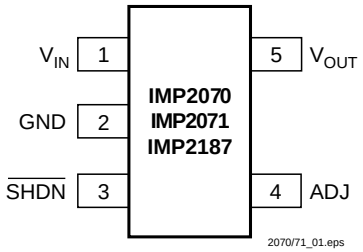
Pin Configuration

SOT-23A



2070/71_01.eps

Pin Descriptions

Pin Number	Name	Function
1	V_{IN}	Unregulated supply input.
2	GND	Ground terminal.
3	$\overline{SHDN}$	Shutdown control input. A shutdown mode is entered when $\overline{SHDN}$ is a logic LOW. During shutdown the output voltage falls to 0V and quiescent current drops to 2.0µA.
4	ADJ	Output voltage adjustment terminal.
5	V_{OUT}	Output voltage.

2070/71_t01.eps

Ordering Information

Part Number*	Package	Output Voltage (V)	Output Current (mA)	Shutdown Pin	Adjust Pin	ERROR Flag Output	Reference Bypass Pin	Package Marking			
								A	B	C	D
IMP2070JUK/T	SOT23A-5	Adjustable	60	●	●			J	J	x	x
IMP2071JUK/T	SOT23A-5	Adjustable	110	●	●			K	J	x	x
IMP2187JUK/T	SOT23A-5	Adjustable	160	●	●			L	J	x	x

xx = Date Code * /T indicates Tape and Reel

2070/71_t03.eps

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Absolute Maximum Ratings

Input Voltage 7V
Output Voltage . . . . . –0.3V to V_{IN} + 0.3V
Maximum Voltage on Any Pin . . . . . –0.3V to (V_{IN} + 0.3V)
Shutdown Voltage ($\overline{SHDN}$) . . . . . $\overline{SHDN} \le V_{IN}$ + 0.3V

These are stress ratings only and functional operation is not implied. Exposure to absolute maximum ratings for prolonged time periods may affect device reliability. All voltages are with respect to ground.

Operating Junction Temperature Range . . . – 40°C < T_J < 125°C
Storage Temperature . . . . . – 65°C to 150°C
Power Dissipation . . . . . Internally limited

Note: T_J = Junction Temperature, T_A = Ambient Temperature

Electrical Characteristics

$V_{IN} = V_{OUT}$ +1V, I_L = 100µA, C_L = 1µF, $\overline{SHDN} > V_{IH}$, T_A = 25°C, unless otherwise noted. **Bold/blue** specifications apply for junction temperature range –40°C < T_J < 125°C.

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Input Voltage Range	V_{IN}	0°C < T_J < 125°C			**6.50**	V
		–40°C < T_J < 125°C			**6.50**	
Maximum Output Current	I_{OMAX}	IMP2070	**60**			mA
		IMP2071	**110**			
		IMP2187	**160**			
Adjustable Output Voltage Range			V_{REF}		5.5	V
Reference Voltage	V_{REF}		**1.165**	1.20	**1.235**	V
Dropout Voltage (Note 1)	V_{IN} - V_O	I_L = 100µA		1		mV
		I_L = 20mA		17	**23**	
		I_L = 50mA		60	**70**	
		I_L = 100mA (IMP2070, IMP2187)		90	**160**	
		I_L = 150mA (IMP2187)		143	**250**	
Quiescent Current (Ground Current)		No load		33	**50**	µA
Shutdown Supply Current	I_{INSD}	$\overline{SHDN}$ = 0V $T_J \le$ 25°C		0.2	2	µA
Output Temperature Coefficient				40		ppm/°C
Thermal Regulation				0.04		%/W
Line Regulation		V_R + 1V ≤ V_{IN} ≤ 6V		0.0375	**0.35**	%

2070/71_t02a.eps

Notes: 1. Dropout Voltage is defined as the difference between IN and OUT when V_R drops 2% below its nominal value.
2. Specifications which would otherwise be affected by self-heating of the die are tested at a constant die temperature by using low duty cycle pulse testing.
3. PSRR guaranteed by design.

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Electrical Characteristics

$V_{IN} = V_{OUT}$ +1V, I_L = 100µA, C_L = 1µF, $\overline{SHDN} > V_{IH}$, T_A = 25°C, unless otherwise noted. **Bold/blue** specifications apply for junction temperature range of –40°C < T_J < 125°C.

Parameter	Symbol	Conditions		Min	Typ	Max	Units
Load Regulation:							
IMP2070		I_L = 100µA to 50mA			0.32	**2.0**	%
IMP2071		I_L = 100µA to 100mA			0.32	**2.0**	
IMP2187		I_L = 100µA to 150mA			0.32	**3.0**	
Thermal Shutdown Die Temperature					150		°C
Thermal Shutdown Hysteresis					12		°C
Ripple Rejection	PSRR	$V_{IN} \geq (V_O + 1V) \pm 0.25V$ C_O = 3.3µF ceramic	Freq. = 1kHz		58		dB
			Freq. = 10kHz		45		
			Freq. = 1MHz		34		
Output Noise		300Hz to 50kHz I_L = 50mA (IMP2070) I_L = 100mA			280		μV_{RMS}
$\overline{SHDN}$ Input HIGH Threshold		2.5V ≤ V_{IN} ≤ 6.5V		**45**			% of V_{IN}
$\overline{SHDN}$ Input LOW Threshold		2.5V ≤ V_{IN} ≤ 6.5V				**15**	% of V_{IN}
$\overline{ERROR}$ Flag Minimum Supply Voltage				1.5			V
$\overline{ERROR}$ Flag Threshold Voltage		V_{TH}			$0.95V_R$		V
$\overline{ERROR}$ Flag Hysteresis		V_{HYS}			50		mV
$\overline{ERROR}$ Flag Output Low Voltage		$I_{\overline{ERROR}}$ = 1mA			75	**400**	mV
Reverse Current into V_{OUT}		$V_{(IN)} < V_{(OUT)}$ $\overline{SHDN}$ = HIGH = V_{IN}			2.0		mA
		$V_{(IN)} < V_{(OUT)}$ $\overline{SHDN}$ = LOW			2.7		µA
Output Current Limit					350	**600**	mA
Adjust Input Leakage Current	I_{ADJ}				50		pA

Notes: 1. Dropout Voltage is defined as the difference between IN and OUT when V_R drops 2% below its nominal value.

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2. Specifications which would otherwise be affected by self-heating of the die are tested at a constant die temperature by using low duty cycle pulse testing.

3. PSRR guaranteed by design.

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Typical Characteristics

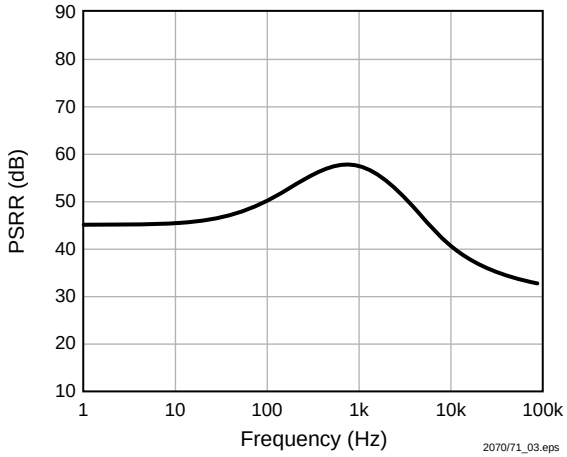

Figure 1. IMP2070 PSRR at I_{LOAD} = 100mA

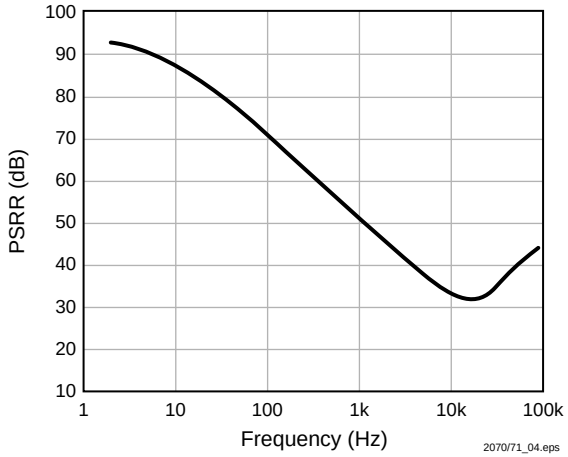

Figure 2. IMP2070 PSRR at I_{LOAD} = 1mA

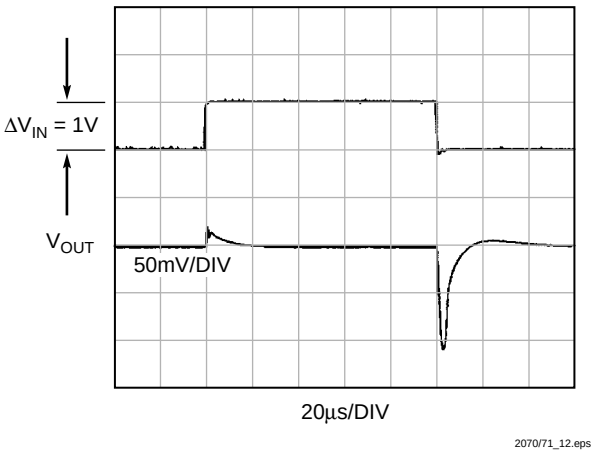

Figure 3. Line Transient Response

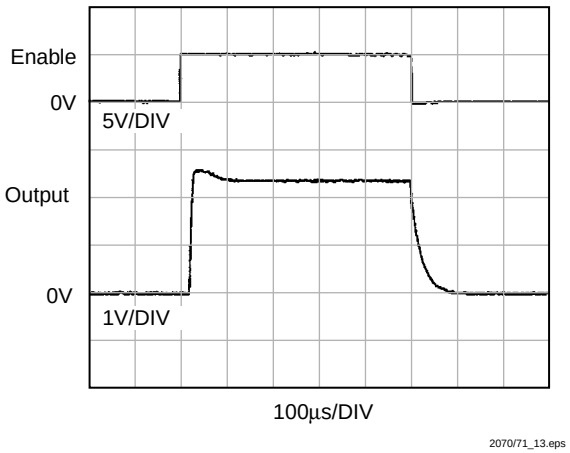

Figure 4. Enable Input Response

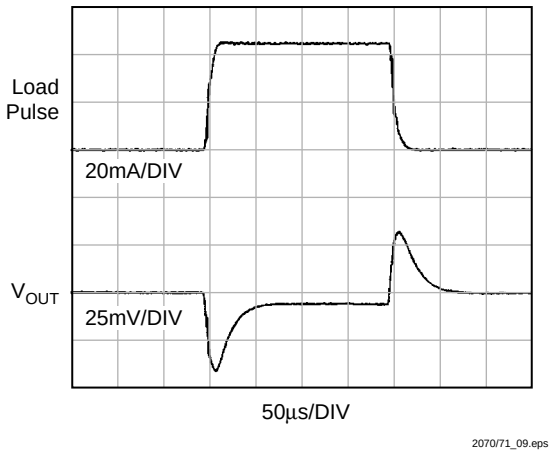

Figure 5. Load Transient Response (50mA Step)

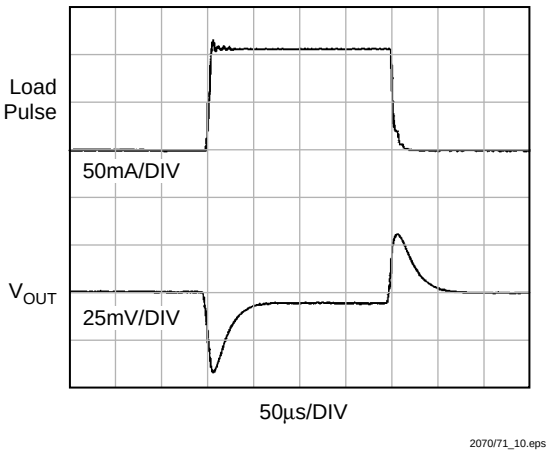

Figure 6. Load Transient Response (100mA Step)

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Typical Characteristics

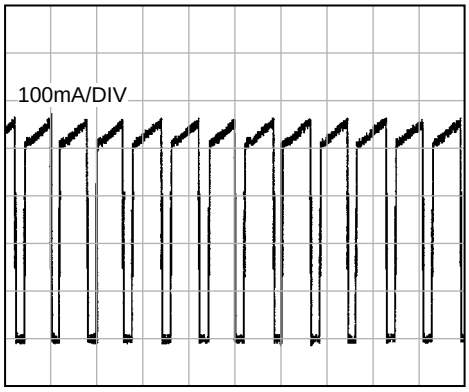

Figure 7. Output Current Limit

Application Information

The IMP2070, IMP2071 and IMP2187 have been designed to offer exceptionally low dropout voltage, adjustable outputs, superior load regulation and minimum quiescent power.

Shutdown Mode

A battery-life-extending mode is available. Through the active LOW shutdown pin, $\overline{SHDN}$, the regulator can be enabled or turned off. The regulator is shutdown (turned off) when $\overline{SHDN}$ is LOW and enabled (turned on) when $\overline{SHDN}$ is HIGH.

The shutdown signal can be supplied from a CMOS gate or from an I/O port of a microcontroller.

During shutdown, the output voltage falls to 0V and the supply current is typically only 200nA.

If the shutdown mode is not needed, $\overline{SHDN}$ should be connected directly to the regulator input voltage pin.

Output Voltage Adjustment

Adjust Input

The output voltage setting is determined by the values of R1 and R2 (*Figure 8*). These resistors should be between 470kΩ and 3MΩ to minimize current.

The output voltage setting is calculated using the following equation.

$$V_{OUT} = V_{REF} \times \left[1 + \frac{R1}{R2}\right]$$

The voltage adjustment range of the IMP2070, IMP2071, and IMP2187 is from V_{REF} to (V_{IN} –0.05V). A small capacitor (100pF to 0.01µF) may be added to the ADJ input to further reduce output noise. A typical 2.45V battery operated supply is shown in *Figure 8*.

Output Capacitor

The IMP2070, IMP2071 and IMP2187 were designed for stable operation with a wide range of capacitor values and type. The output capacitor should be above 0.47µF. A 1µF value is recommended. Ceramic or tantalum capacitors are suitable with an ESR up to 5Ω.

Thermal Shutdown

An on-chip thermal protection circuit shuts the LDO regulator off when the die temperature exceeds 150°C. There is a built in 12°C hysteresis. The regulator will remain off until the die temperature drops to approximately to 138°C.

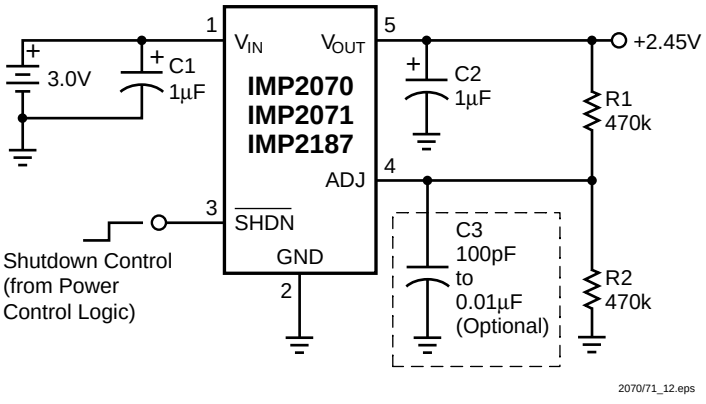

Figure 8. 2.45 Battery-Operated Supply

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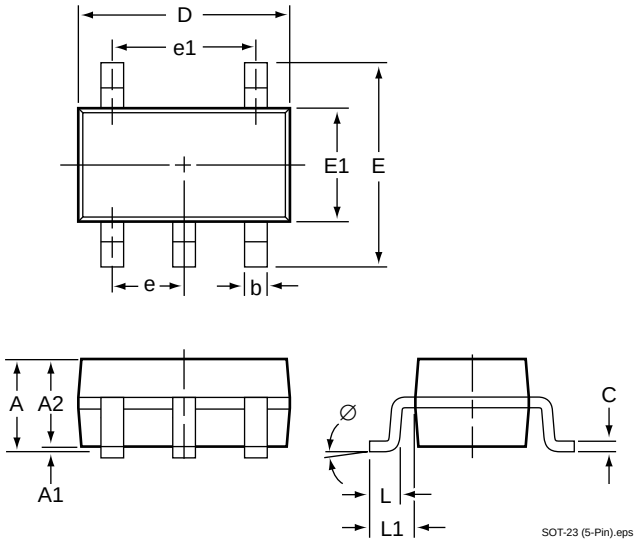
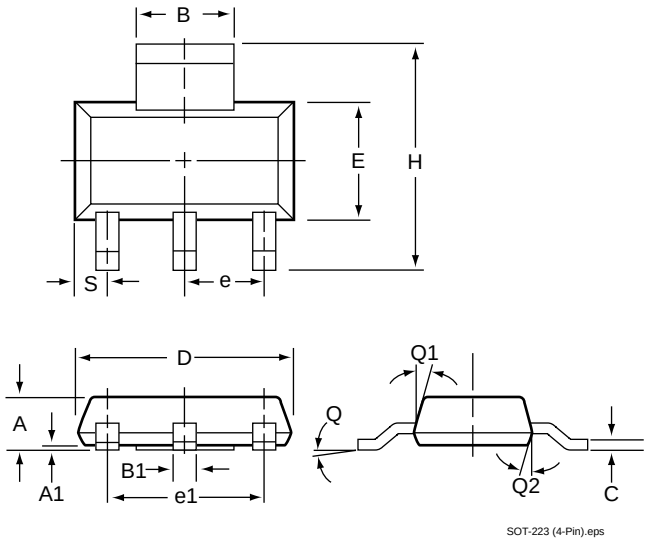
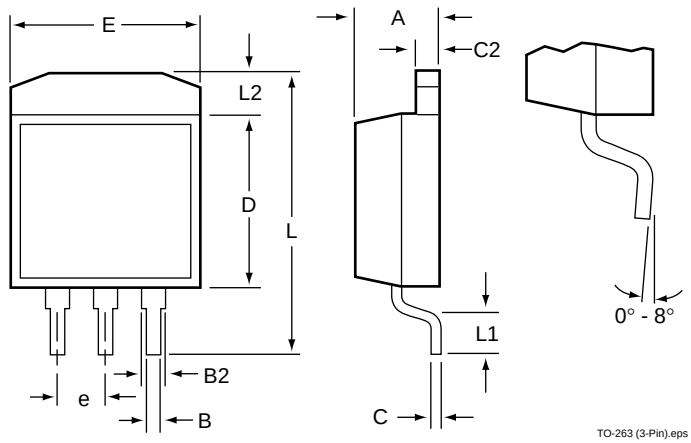
Plastic SOT-23A (5-Pin)



Plastic SOT-223 (4-Pin)



Plastic TO-263 (3-Pin)



Package Dimensions

	Inches			Millimeters		
	Min	Nominal	Max	Min	Nominal	Max
Plastic SOT-23A (5-Pin)*						
A	0.037	——	0.057	0.95	——	1.45
A1	0.001	——	0.005	0.05	——	0.15
A2	0.035	0.044	0.050	0.90	1.15	1.30
b	0.011	——	0.019	0.30	——	0.50
b1	0.011	0.015	0.017	0.30	0.40	0.45
c	0.003	——	0.007	0.08	——	0.20
c1	0.003	0.003	0.062	0.08	0.10	0.16
D	0.109	0.113	0.117	2.80	2.90	3.00
E	0.101	——	0.117	2.60	——	3.00
E1	0.058	0.062	0.066	1.50	1.60	1.70
e	0.037 BSC			0.95 BSC		
e1	0.074 BSC			1.90 BSC		
L	0.013	0.017	0.021	0.35	0.45	0.55
L1	0.002 REF			0.60 REF		
∅	0°	——	8°	0°	——	8°
Plastic SOT-223 (4-Pin)**						
A	0.067	——	0.060	1.70	——	1.50
A1	0.004	——	0.0008	0.10	——	0.02
B	0.124	——	0.116	3.15	——	2.95
B1	0.033	——	0.026	0.85	——	0.65
C	0.014	——	0.010	0.35	——	0.25
D	0.264	——	0.248	6.70	——	6.30
e	0.0905 NOM			2.30 NOM		
e1	0.181 NOM			4.50 NOM		
E	0.146	——	0.130	3.70	——	3.30
h	0.287	——	0.264	7.30	——	6.70
S	0.041	——	0.033	1.05	——	0.85
t	0.051	——	0.043	1.30	——	1.10
Q	10° MAX			10° MAX		
Q1	16°	——	10°	16°	——	10°
Q2	16°	——	10°	16°	——	10°
TO-263 (3-Pin)***						
A	0.160	——	0.190	4.059	——	4.821
B	0.020	——	0.039	0.507	——	0.989
B2	0.045	——	0.055	1.141	——	1.395
C	0.018	——	0.029	0.456	——	0.735
C2	0.045	——	0.055	1.141	——	1.395
D	0.340	——	0.380	8.627	——	9.642
E	0.380	——	0.405	9.642	——	10.276
e	0.100 BSC			2.537 BSC		
L	0.575	——	0.625	14.59	——	15.858
L1	0.090	——	0.110	2.283	——	2.791
L2	——	——	——	——	——	——

** JEDEC Drawing MO-178*
*** JEDEC Drawing TO-261AA*
**** JEDEC Drawing TO-263AA*
♦ *Add /T to Part Number for Tape and Reel.*

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